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AUTHOR Javor, Constance M.
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ABSTRACT

The progress of a class of tenth grade Honors Biology I students learning in an open space learning environment during the first six weeks of the 1985-86 school year was compared to the progress of a similar class studying under the same teacher in a traditional, closed classroom the following year. The study was conducted in Westfield High School (in Texas's Spring Independent School District), a school that was remodeled between the two school years from an open space configuration to a more traditional design. Student progress was tested by comparing pretest scores from the first week of the year to scores achieved at the end of the first six weeks. A t-test revealed no significant relationship between student achievement and building design. A questionnaire completed by 36 of the high school's 120 teachers indicated that teachers (1) found conditions in open space buildings more disruptive, (2) associated closed classrooms with greater teacher-student interaction, and (3) believed that closed classrooms were preferred by parents, students, and teachers. This report also provides a review of related literature, an appendix containing the classroom design questionnaire for teachers, and a two-page bibliography. (PGD)

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EFFECTS OF CLASSROOM DESIGN ON STUDENT ACHIEVEMENT

by
Constance M. Javor

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submitted in partial fulfillment
of the requirements for Methods of Research
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CHAPTER 1

Introduction

General Introduction

Choosing the most effective building design to facilitate learning is a choice faced by school administrators in many growing districts. Since building design is a factor which may influence student attitude and achievement, it is a concern to which much thought should be given.

In the early 1970s open space architectural design was used in the construction of many new schools. Open space schools were designed to serve each individual student in his or her pursuit of learning.¹

Along with the architectural design of open space schools came a different philosophy in teaching style called open concept or open education. This teaching style "promotes flexible arrangements to permit individualized learning and continuous growth."² This style shifts the emphasis from passive student learning to active student learning by providing a flexible, open environment.

Complaints from parents, teachers, and administrators have caused many of the open space classes of the 1970s to be architecturally modified. This modification was generally accomplished in a series of stages. First, teachers used

movable cabinents, bookshelves, and portable blackboards to divide large areas in an attempt to lessen noise. Next, administrators partially enclosed large areas by constructing partial walls to create smaller areas of semi-openness. This design was called flexible space. Finally, the entire building was modified into the traditional closed space classroom design.

Statement of the Problem

Leaving an open space school in June and returning to a closed classroom in August is a challenge few students and teachers ever face. Yet this is the situation that Spring Independent School District secondary students and teachers confronted in 1986. Adjustment to this situation and an analysis of student achievement in the open space environment versus student achievement in the closed classroom is therefore a topic of utmost concern to these teachers and administrators.

Purpose

The purpose of this study was to investigate the question of whether school design has any effect on student achievement. Student achievement was assessed using a pretest of prerequisite skills and by comparing the first six weeks averages for two classes. One class was conducted in an open space environment and the second class was held in a closed classroom.

Importance of the Study

Determining the relationship between school design and student achievement may provide valuable information. This information may be useful in determining appropriate designs for new buildings in the Spring Independent School District as well as in other school districts. This information can also aid in determining the appropriate design for building modifications and for the remodeling of present schools.

Assumptions

This study involves tenth grade students in Honors Biology I courses. It is assumed that the students in honors science classes have similar educational backgrounds and similar academic abilities. It is also assumed that students will face the same adjustment problems to a new class and a new teacher for the first six weeks period. The assumption can be made that the curriculum and teaching style is the same for each class.

Definition of Terms

Contained area - the traditional four-wall classroom.

Flexible space school - A school consisting of both open and contained areas utilized to best meet the needs of students and teachers.

Open area - A large instructional area physically distinguished by a lack of permanent walls.

Open concept - A teaching style that results from the belief that students learn best when they can actively

explore their environment, are given responsibility for their own learning, and can interact informally with teachers and other students.

Traditional classroom - a classroom with four walls; a self-contained classroom.

Limitations and Delimitations

This investigation is limited to high school students in the Spring Independent School District. It is delimited to Westfield High School students in a random sample of tenth grade Honors Biology I classes. The study includes only two classes, one from the 1985-1986 school year and one from the 1986-1987 school year. The only physical factor under study is the presence or absence of walls.

Null Hypothesis

There is no relationship between student achievement and building design.

Procedures

This study involves two classes of tenth grade Honors Biology I students. Class A was a morning class of twenty five students from the 1985-1986 school year and Class B was a morning class of thirty students from the 1986-1987 school year. Class A was in an open area school and Class B was in a contained area. The classes were heterogeneous with fifteen boys and sixteen girls in Class A and fourteen boys and sixteen girls in Class B. The teacher and the curriculum were the same for each class. Student grades were compared

on the pretest given the first week of school and student averages were compared for the first six weeks grading period. Student achievement was assessed using the t-test. A teacher questionnaire was also administered concerning attitudes of teachers, students, and parents toward the open environment versus the closed classroom.

CHAPTER 2

A Review of Related Research

Considerable research has been conducted comparing open area schools to traditional schools. A majority of the research, however, has been conducted in the primary grades. The research varies from topics such as student achievement to teacher and student attitudes. Most of the research data were gathered in the late 1970s and early 1980s and the results of the different studies are often conflicting.

There are many arguments for and against open area schools. One argument in favor of open area schools is related to their economy and flexibility.³ Not all students, however, can handle the many distractions of an open space school and this is an area of frequent parental complaint.

In a 1980 study comparing open area and contained classrooms it was found that the type of classroom design made no significant difference in the students' attitude or achievement in high school social studies classes. It was found, however, that the noise level and the level of visual distraction was much greater in the open space class than in the closed classroom. The major conclusion drawn from the study was the fact that the teacher is a more significant factor in the learning situation than any physical factor.⁴ A guide written to aid teachers in open space schools also

points out the importance of the teacher in any physical setting. In this guide Smith states that the actual facility⁵ is much less important than the human element.

An extensive study in 1982 investigated students' attitudes regarding differential teacher treatment in open area and traditional classrooms. Data supported the conclusion that there were no significant differences in student treatment with regards to sex and achievement level of students between open area and traditional classrooms.⁶

In a 1981 study on student attitudes regarding innovations, Faust determined that students favored the open classroom to the traditional classroom. Faust concluded that some innovations create positive attitudes toward the programs and thus produce achievement levels equivalent to those in traditional programs.⁷

Extensive research was conducted on school environments in Australia in 1979. This study found a consistent trend toward higher cognitive outcomes in traditional schools. With regards to attitude toward school, however, open area schools were favored.⁸ Fraser and Rentoué investigated the "person-environment fit in open classrooms" and determined that "the actual preferred (or personal environment) interaction rather than the actual openness of the classroom environment per se was important in predicting cognitive outcomes."⁹

In a review of the research on the physical environment

of the school, Carol S. Weinstein reports that no significant differences were found in reading comprehension due to the noise in an open space school. Teacher attitudes toward school were much more favorable in open area schools as were student attitudes.¹⁰

A lengthy study of the needs and concerns of parents, students, and teachers in the Spring Independent School District was conducted during the 1981-1982 school year. The open concept classroom was identified as one of the major concerns of all three groups surveyed. About fifty percent of the parents surveyed approved of the open concept classroom. The two reasons most often mentioned in favor of open concept was the achievement of the students and the belief that the open concept provided a better learning environment. Of thee 40.8 percent of the parents who disapproved of the open concept, most stated that it was too difficult for the students to concentrate in that type of environment.¹¹

In a student survey, fourteen percent of the elementary children, three percent of the middle school students, and twelve percent of the high school students stated that open concept classrooms were a major problem area.¹²

A survey of teachers revealed that 46.5 percent approved of open concept classrooms, 44.1 percent disapproved, and 9.4 percent did not offer approval or disapproval. Teachers in favor of open concept stated reasons such as flexibility of grouping, team teaching, teacher relationships, and

improved discipline as positive factors. Teachers who disapproved stated negative factors as being the noise level, limitations on teaching strategies, and emphasis on control¹³ of student behavior at all times.

The results of this research led to architectural design changes resulting in flexible space classrooms in the summer of 1983 and further modification to closed classroom design in the summer of 1986.

CHAPTER 3

Presentation of Data

A pretest was administered to students in Class A in the open area during the first week of the 1985-1986 school year. The same test was given to Class B in the closed classroom during the first week of the 1986-1987 school year. The test is designed to assess the prerequisite skills which students are expected to have mastered in previous science courses.

Class A had an average of 77.12 on the prerequisite test compared to an average score of 76.43 for Class B. The majority of the students scored between eighty and ninety percent on the test as shown in the percentage breakdown of scores in Table 1.

Table 1

Grade Distribution on Prerequisite Test

	A (90-100)	B (80-89)	C (75-76)	D (70-74)	F (Below 70)
Class A	12%	72%	12%	0%	4%
Class B	7%	43%	10%	13%	27%

Class A and Class B were also compared on the basis of the students' final average for the first six weeks grading period. The overall mean score for Class A was 84.88 as

compared to an average of 86.87 for Class B. The majority of the students in Class A scored between eighty and ninety percent while the students in Class B scored almost equally in the ninety to one hundred and eighty to eighty-nine percent range. The percentage breakdown of grades is shown in Table 2.

Table 2

Grade Distribution of Six Weeks Averages

	A (90-100)	B (80-89)	C (75-79)	D (70-74)	F (Below 70)
Class A	12%	76%	8%	0%	4%
Class B	43%	37%	14%	3%	3%

A t-test was used to determine if there was a significant difference between the pretest scores of Class A and those of Class B. The results of the test are shown in Table 3. Based on the 0.05 level of significance, the obtained level of 0.80 probability shows no significant difference between the pretest scores of the two classes.

Table 3

t-test Analysis of Prerequisite Scores

	Class Size	Mean Score	Standard Deviation	Level of Probability
Class A	25	77.12	8.757	1.00 P
Class B	30	76.43	10.710	0.80 P

The final six weeks averages for Class A and Class B were also assessed using the t-test. Based on the 0.05 level of significance, the obtained level of 0.31 probability shows no significant difference between the averages of the two classes. The results of the t-test are presented in Table 4.

Table 4

t-test Analysis of Six Weeks Averages

	Class Size	Mean Score	Standard Deviation	Level of Probability
Class A	25	84.88	6.698	0.31 P
Class B	30	86.87	7.464	1.00 P

A questionnaire (Appendix A) was administered to teachers regarding their attitude toward open and closed classrooms. Sixty questionnaires were randomly distributed. The faculty consisted of 120 high school teachers of all subject areas. The return rate was sixty percent.

The majority of the teachers responding associated the open area design with a greater noise level, more discipline problems, and more outside interruptions. Most teachers felt that there is greater teacher-student interaction in the closed classroom and that the closed classroom design is preferred by teachers, parents, and students. The results of the questionnaire are summarized in Table 5.

Table 5
Teacher Attitudes Toward Open Area
and Closed Classrooms

	No Response	Open Area	Closed Area
More outside interruptions	3%	94%	3%
More discipline problems	6%	75%	19%
More teacher-student interaction	8%	6%	86%
Greater noise level	6%	80%	14%
Parent preference	14%	0%	86%
Student preference	11%	19%	70%
Teacher preference	3%	0%	97%

CHAPTER 4

Interpretations

Summary

Class A in the open classroom had a slightly higher average than Class B in the closed classroom on the pre-requisite test. The mean scores were 77.12 and 76.43 respectively. The t-test shows a 0.80 level of probability which is not statistically significant.

The first six weeks average for Class A was slightly lower than the average for Class B. The mean score for Class A was 84.88 and for Class B was 86.87. The t-test shows a .31 level of probability which is not statistically significant.

According to the response to the teacher questionnaire, teachers associate more outside interruptions, more discipline problems, and a greater noise level with the open area classes. Teachers perceive the closed classroom as being associated with more teacher-student interaction and as the design of preference of parents, students, and teachers.

Conclusions

Based on the results of this study it can be concluded that there is no significant relationship between student achievement and building design. Students in the closed

classroom did not exhibit better proficiency on the prerequisite test nor did they display a better acquisition of subject knowledge for the first six weeks grading period.

Based on the data gathered, parents, students, and teachers prefer the closed classroom to the open area design classes due mostly to the increased teacher-student interaction and the decreased noise level.

Evidence from this study and past research seem to indicate that the individual teacher may be a more critical factor in student learning than is any measurable physical factor.

Recommendations

Further studies should be conducted to determine if other physical factors influence student achievement. Suggested topics would be the effect of class size, the effect of classroom temperature, and the effect of room color on student attitude and achievement.

A study could also be approached from the standpoint of other persons involved in school design. Suggestions would be a survey of the attitudes of parents, students, and administrators.

APPENDIX A

CLASSROOM DESIGN QUESTIONNAIRE

Directions: Please fill in or check the appropriate answer to each question.

O = Open Classroom

C = Closed Classroom

1. What is your age? ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-
2. Sex..... ☐ M ☐ F
3. Number of years teaching experience.....
4. Grade level you presently teach for the majority of the day.....
5. Subject area you presently teach for the majority of the day.....
6. Years of teaching experience in..... ☐ O ☐ C
9. There are more outside interruptions in.... ☐ O ☐ C
10. There are more discipline management problems in..... ☐ O ☐ C
11. There is more teacher-student interaction in..... ☐ O ☐ C
12. The noise level is greater in..... ☐ O ☐ C
13. Parents prefer the..... ☐ O ☐ C
14. Students prefer the..... ☐ O ☐ C
15. Teachers prefer the..... ☐ O ☐ C
16. Has your teaching style changed in the closed classroom?..... ☐ Y ☐ N
16. List two factors which you consider to be advantages of the open classroom.

17. List two factors which you consider to be disadvantages of the open classroom.

Notes

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